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ABSTRACT

Career planning seminars conducted by the Student Activities Committee of the Los Angeles Section of the American Institute of Aeronautics and Astronautics are discussed. The seminars address a forecast of trends in engineering; a discussion of opportunities in new engineering areas; and consideration of individual career goals. A sampling of a detailed evaluation of the first six seminars is presented. (MLH)

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THE CAREER PERSPECTIVE SEMINAR

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The Career Perspective Seminar

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Summary

The Career Perspective Seminar was developed in response to student needs in career planning. The seminars address a forecast of trends in engineering; a discussion of opportunities in newer, emerging engineering areas; consideration of individual career goals and some suggestions related to the more traditional career preparation activities of resume development and practice interviews. A sampling of a detailed evaluation of the first six Seminars is presented and discussed. The enthusiastic student response to the Seminar is, perhaps, its best measure of success.

Introduction

Engineers, in general, have technical areas of interest in which they would like to establish and pursue a professional career. For all concerned, the happiest situation occurs when the requirements of an engineering position are matched by the capabilities and desires of the engineer filling that position.

In the early sixties there seemed to be more engineering positions than engineers to fill them. In this type of professional environment, the individual engineer had little trouble in establishing a career in his particular area of interest. Events of the late sixties and early seventies changed this employment environment. Consequently, several types of reactions could be observed:

(1) Some engineers were not able to generalize their education and experience and thereby effect changes in employment that would result in meaningful changes in their career.

(2) Some engineers felt that engineering technical and professional societies were directed by segments of the engineering profession which did not adequately reflect the desires nor meet the needs of the average member. They consequently ceased to maintain membership in such societies. A few engineers in this category began advocating radical solutions to the profession's ills.

(3) Some engineers became unhappy with the profession and left for opportunities in other fields. Several returned to school. A few have gone into business for themselves. Many had perhaps been contemplating career changes in any event.

(4) Some engineers attempted to ignore the twin problems of reduced funding for major projects and the anti-technology sentiment that persists today in segments of the population. Along these lines Smith[1] has suggested that the public understanding of technology is almost inversely proportional to the impact of technology on our life style.

(5) Some engineers recognized the problem as one of career development. They began to reassess their careers and redirect them in ways that were more rewarding professionally and more satisfying personally.

(6) Many engineers continued with business as usual.

The essential observation from this period is that most engineers had given precious little thought to career planning. Perhaps too many were busy pursuing "the good life." The net result was that few engineers had viable alternatives to utilize in the pursuit of career objectives. In short, many engineers had navigational problems with their career. It became evident that many engineers

had not given much thought to career development. Because of their proximity to the problem, many engineers were not able to bring the clarity of vision and analytical background to bear that would have been used on an "impersonal" technical problem.

A number of factors such as information obsolescence, mobility, manpower requirements, specialization (or lack of it), age, national and local economies and shifts in national priorities contributed to the feelings, attitudes and events cited above. In viewing the overall problem, it seems apparent that continuous career planning must be given adequate attention by every engineer.

Career Inception

The typical engineer made a decision to enter the engineering profession either in high school or somewhere early in his or her college education. As a freshman, perhaps, he or she set a four (or five) year goal to obtain a degree in engineering. It therefore seems logical that career planning should begin at the student level and continue through the professional career. With this concept in mind, a Career Perspective Seminar was first conducted in the early part of 1972 by the Student Activities Committee of the Los Angeles Section of the American Institute of Aeronautics and Astronautics (AIAA).

The Career Perspective Seminar (CPS) was conceived as a five meeting seminar with one meeting each week for a five week time period. The order and topics of the meetings are as follows:

(1) Part I - Industry Forecast: Where is the engineering profession going in the next 5-10-20 years? Often presented by a senior manager of a major firm, and often couched within that firm's frame of reference. In addition to information content, this session also exposes the participants to the

type of long range planning a company must undertake.

Part II - Emerging Opportunities: What emerging opportunities are presenting themselves now? This presentation often involves a discussion of the implications of various market forces at work in our economy.

(2) Engineering Society Aided Career Development: Representatives of the California Society of Professional Engineers (CSPE) or NSPE and four or five technical societies such as AIAA, ASME, AIIE and IEEE discuss, as a panel, why an engineer should join a professional or technical engineering society.

(3) Career Objectives: What are the immediate, intermediate and long term goals and objectives of the individual engineer; small group participation.

(4) Personal evaluation of past education and accomplishments. Preparation and critique of resumes. Small group participation.

(5) Personal evaluation of present engineering opportunities: Practice interviews. Small group participation.

This format has evolved to its present form and may undergo additional modification until its optimum profile is achieved. Each CPS is hosted by a Student Branch of AIAA in cooperation with the Student Activities Committee of the Los Angeles Section of AIAA. There are six AIAA Student Branches within the Los Angeles and Orange County area. The seminars are open to any student who wishes to attend and no fees are assessed. Refreshments are generally provided by the host Branch. Two or three Seminars have been held each year since the programs inception.

Industry Forecast

The first meeting of the Seminar has two elements or components. One element is the Industry Forecast. There are at least two approaches to the forecast. One approach is to estimate the concerns of engineering in the near as well as distant future. The forecast span should be in the neighborhood of 5 to 20 years.

The second approach is to estimate the capabilities which engineers will need in the forecast span of 5-20 years. Clearly, the capabilities of the engineer need to match the concerns of industry. Hence, the two approaches represent two perspectives of the same series of events.

Typically, an individual in high level engineering management is requested to volunteer his personal view of the direction in which the engineering profession is moving. There has been a generous response by engineering management to attempt to provide students with some insight of the future of their chosen profession.

Toffler[2] suggests that, if people are to manage their own future, they must be prepared to anticipate that future. As engineers we anticipate the future when we conceive the development of space exploration, mass transit and environmental control systems to be implemented in some five to fifteen years. It is hoped that by providing the Seminar participant with a suggestion of the future of his profession, he can better evaluate his own goals within that profession.

As a result of the industry forecast it is expected that the student will gain a clearer perspective of future engineering problems requiring creative and innovative solutions. It is expected that the student will have a better understanding of the influence and responsibilities his profession will have with respect to the society in which he lives. As a consequence of the industry forecast, the student should be able to list several possible growth areas in engineering.

The usefulness of the industry forecast lies in the belief that it provides some idea of the technological events that may occur within the timespan of the forecast.[3,4,5] Forecasts must be periodically updated if they are to be of value in anticipating the future. The engineer can update technological forecasts in many ways using available information in industry, governmental and professional publications.[6,7,8,9] Although a particular forecast is not always right, it can suggest trends which are useful in projecting career goals.

The typical engineering student has already engaged in some career forecasting. As a freshman, he or she set a four or five year goal of obtaining an engineering degree from a college or university of his or her choice. The Seminar simply suggests that career planning and development is a continuous task. The Seminar also suggests some resources to aid the individual in his or her career planning.

Emerging Opportunities

Emerging opportunities in engineering represents a subject of immediate concern to engineering students. An early effort in this area was the 1970 "Emerging Opportunities in Engineering" conference held at the Jet Propulsion Laboratory in Pasadena. At that time attention was directed to housing and urban systems, crime prevention, oceanography, transportation systems, pollution control and medical engineering.[10] Acoustics, technology assessment and earth resources might also be added to the list.

This segment of the Seminar provides the participant with an overview of new problems or problem areas which are being treated by engineering methodology. At the present time most of these areas are concerned with engineering applications to civil systems. As a result, attention is often given to direct engineering approaches to broad social problems e.g., crime prevention and mass transit.[11,12,13]

These areas are considered "emerging" in the sense that they represent problem areas in which high level technology has not been systematically used in the past. The emerging areas provide the engineering student with a view of immediate opportunity to apply engineering concepts to problems subjected to boundary conditions established by a multitude of cultural constraints.

Some of the emerging areas may represent problems that will grow in magnitude and therefore represent significant major engineering concerns in the future. Introducing the engineering student to a number of emerging areas will permit him to include those areas of interest in his future career plans. In addition to being aware of the emerging areas it is necessary for the engineer to be aware of the technology-society interface. Familarity with this interface is required if engineering solutions to social problems are to be effectively implemented. The 2nd Urban Technology Conference and Technical Display[14] represents a current professional effort to define some emerging areas as well as the society-technology interface. This conference involved some seventeen engineering and government or government related organizations.

Rightly or wrongly, engineers have been accused by some segments of society of not being sufficiently concerned with the technological impact of science on the society in which we live. The emerging areas segment of the Seminar serves to introduce the engineering student to emerging ways in which engineering can serve the society in which we live.

As a consequence of the emerging areas segment of the Seminar, the participant should be able to identify several emerging areas of engineering opportunity. The student should recognize such areas as possible growth areas and therefore areas of concern in his continuing career development. The participant should also recognize the emerging areas as opportunities for his chosen profession to serve the society in which he lives.

Engineering Society Aided Career Development

The second meeting of the CPS is devoted to an exploration of the ways in which engineering technical and professional societies contribute to the career development of the engineer. Most engineering societies purport to assist the individual engineer in the process of his career development.

Typically a representative of CSPE or NSPE and representatives of some four or five technical societies discuss, as a panel, the ways in which a professional or technical society can help the individual engineer fully develop his professional career. In addition to an AIAA representative, ASME, IEEE and AIIE representatives are often included on the panel.

Each technical society representative is given ten to fifteen minutes to discuss ways in which his society responds to the individual career development needs of its members. Because of the umbrella nature of the organization, the NSPE representative is usually given fifteen-twenty minutes. It is recognized that most engineering organizations hold specialists meetings and technical meetings to provide its members with state-of-the-art engineering data. Most engineering organizations also attempt to meet other professional but non-technical needs of its members. These needs might include portable pensions, contractual ethics, dual advancement channels, lifelong learning, public advocacy, technology assessment, legal advice on employment matters, information on salaries and group savings and benefit opportunities.

The non-technical aspects of an engineering career have been discussed to some degree by Marlowe.[15] Developments in the concept of portable pensions has been treated by Tormey.[16] As an engineer develops his career he may find that his career is enhanced by membership in more than one society e.g., AIAA and NSPE.

Societies are beginning to accept joint sponsorship for a number of technical meetings. Inter-Society cooperation is discussed in an Astronautics & Aeronautics editorial by Goland.[17] There is a growing need for engineering societies to cooperate in the technical and non-technical aspects of their many programs.

The engineering society technical contribution to the development of an engineer's career is easily identified. Technical meetings provide an atmosphere for state-of-the-art dialogue and often stimulate further progress in engineering methodology. Journals provide a means for distributing technical data to those not able to attend the numerous technical meetings. The journals also provide the individual with a vehicle in which he can describe his latest achievements.

Active participation in an engineering society gives the individual engineer the opportunity to give of himself in an effort to make his chosen profession a true servant of his local, national and international community. As a consequence of the Seminar, the student should be able to list several ways in which engineering societies cooperate to benefit him and the social world in which he lives. The student should be able to list several ways in which engineering societies help him to develop technical and non-technical aspects of his career. He should also be able to list several ways in which the engineer interacts with the society in which he lives.

Career Objectives

The third meeting of the Seminar treats the importance of establishing career objectives. It is mentioned above that the individual engineer needs to give careful consideration to the type and scope of engineering that he wishes to practice. This requires the enumeration of career objectives. These objectives represent goals to be achieved at some point in the future. Some objectives will be established for the near future, perhaps tomorrow,

and some will be established for the distant future of some several years hence. The successful engineer will probably seek to establish and modify (as required) these objectives in terms of expected engineering requirements and his own capabilities and interests. External influences will also affect the individuals career objectives. Thompson[18] suggests that to some degree an engineers career is not his own.

Engineering publications contain a great deal of information that can be related to career objectives. The necessity for career perspectives is discussed by Baird.[19] Some of these career perspectives include graduate study without working experience, realistic views of the job market, and overseas employment. Articles such as those by McCarthy[9] and Hyatt[20] can provide the engineer with information relating to projected engineering needs in the future. Such information can be used by the individual as input for personal career projection. The Engineers Joint Council provides considerable information on projected engineering manpower requirements[21] and starting engineering salaries.[22] Engineering salary information is also provided by other engineering publications.[23] The IEEE Transactions on Education recently devoted a special issue to women in engineering.[24] The size of a company may also influence career objectives.[25] Factors governing the instability of engineering positions are discussed by Thompson.[26]

The entire third meeting of the CPS is devoted to discussing career objectives. Typically six to ten students meet with an advisor or moderator during this meeting. To date, most of these advisors have been engineers who have served as counselors with the AIAA Workshop for Professional Employment program (WPE)[27] and who have also worked with student groups. Working with small student groups, the advisors encourage the group participants to consider personal career objectives.

Articles such as those by Swaim,[28] Coryell,[29], Wier,[30] Sprinkle[31] and Summers[32] treat specific requirements in the areas of flight mechanics, operations and tests, support systems, international employment and bio-engineering respectively.

At some appropriate point in the last three meetings, the host Student Branch is encouraged to have some one from their college or university placement center describe the job placement center operation with respect to resume preparation and on-campus interviews.

Participation in the CPS should enable the student to define the importance of career objectives. The student should be able to list some personal career objectives. He will also be aware of some marketing concepts as they apply to personal career objectives. The student will also know of several resources which provide data useful in defining career objectives.

Toffler[2] reports that scientists and engineers in the research and development industry have a job turnover rate that is almost twice as great as for the rest of American industry. In any event, it is reasonable to assume that the individual engineer, will on the average, hold a considerable number of responsible positions during his career. He should, therefore, be able to search the engineering employment market for those positions deemed appropriate for his career objectives. The first job after graduation is of particular interest to the engineering student.

Personal Evaluation: Resumes

The fourth meeting of the Career Perspective Seminar treats the preparation of appropriate letters and resumes for use in an effective job search. This subject is treated in some depth by Hill.[33]

Some time is devoted to the preparation of the letter. The purpose of the letter is to get an interview. Different types of letters are discussed.

The primary thrust of the fourth meeting is the preparation of an effective resume. Resumes may be chronological, functional, or achievement oriented. The different types of resumes are discussed in some length. Typical resumes are discussed with respect to their good features and bad.

Each participant is encouraged by the advisor to write a letter and a resume to enhance his own capabilities. As a result of the Seminar, the participant should be able to effectively prepare his own resume.

Personal Evaluation: Interviews

The fifth and final segment of the Career Perspective Seminar is concerned with preparing participants to effectively interact in interviews. Typically the advisor or moderator acts as employer representative and each member of the group is encouraged to engage in a practice interview. Each interview is then critiqued by the group as a whole. Everyone is involved.

This procedure is somewhat similar to a practice interview program described by Marchman.[34] A central point of this session is that an individual should never go to an interview without preparing for it.

For additional information, each participant is provided with resource references related to job strategy, job opportunities, information about prospective employers (e.g., Dun & Bradstreet, Thomas' Register, College Placement Annual, etc.), problem questions that might arise during interviews and job market areas.

Having participated in the practice interview, it is expected that each student will be better prepared to conduct a successful interview. Follow-up to the interview is also discussed during this last session.

Evaluation

Mager[35] suggests that if something is worth teaching it should be worth knowing if the teaching was successful. With this in mind, specific behavioral objectives were developed for each of the five sessions.

Taxonomies of educational objectives have been organized for the cognitive, affective and psychomotor domains.[36] The taxonomies represent an attempt to classify goals of the educational process. They are intended to help explain the difference in behavior between "one who really understands" and "one who does not understand." The cognitive domain includes the educational objectives related to the recall or recognition of information as well as the development of intellectual skills and abilities.[37] The affective domain is the domain which uses the continuum of internalization as the basis for classifying affective behavior.[38] Internalization is considered to be the process through which there is initially an incomplete and tentative adoption of only the overt manifestations of the behavior of interest and later a more complete adoption. The psychomotor domain is based on the continuum of movement behaviors.[39]

Thirty-five objectives in the cognitive and affective domains were defined for the Career Perspective Seminar. It should be recognized that some aspects of cognitive and affective behavior might be said to be operative just by attendance at the volunteer attendance Career Perspective Seminar.

It was decided that an evaluation should be conducted at each of the five meetings of each seminar. It was believed that the evaluation process would have more acceptance by the participants, if the weekly evaluation required a minimum of time and effort. For this reason only a minimum number of program objectives were actually evaluated. In addition to an evaluation of selective specific objectives, the Seminar participants were requested to rate each of the five sessions. A rating of the overall program was also requested.

A sampling of the evaluation results is presented in Tables I and II. Table I is a sampling of the evaluation of the behavioral objectives. The number of the objective is also the number of the meeting or session at which the evaluation was made. The numbers in each box represent the fraction of participants that attained the stated objective. For example, overall, 0.535 or 53.5% of the participants at the first session of each Seminar were able to list some of the areas identified as emerging opportunities in engineering. This figure is somewhat misleading in that nearly all participants listed at least one area of emerging opportunity. However, the evaluator used the criteria that "some" should mean three or more. Hence, it was necessary for an individual to have listed three or more emerging areas of opportunity in order to be judged as having met the objective. The "three or more" criteria was used in the evaluation of objectives one, two and three. Overall, it can be seen that somewhat more than 50% of the Seminar participants successfully met the criteria for objectives one, two and three.

Table I also indicates that, overall, 0.40 or 40% of the participants wrote a resume. Somewhat more than 0.56 or 56% participated in a practice interview. The n.a. designation indicates that data are not available for that particular session. In other words, someone probably forgot to hand out the evaluation sheets.

Table II presents the average ratings for each session of each Career Perspective Seminar. The ratings were made according to the following scale :

TABLE I

SAMPLE OF
EVALUATION OF BEHAVIORAL OBJECTIVES OF CPS

	OBJECTIVES	CPS #1	CPS #2	CPS #3	CPS #4	CPS #5	CPS #6	Average (a)
1	From the emerging opportunities segment of the meeting, list some of the areas identified as emerging opportunities in engineering.	(b) n.a.	(c) .722	(d) .500	.500	0	.600	.535
2	On the basis of the discussion of the programs of the various technical and professional engineering societies, indicate some of the ways in which technical and professional societies can benefit your career in engineering.	n.a.	.286	.667	.500	1.000	.333	.500
3	Please list some of your career objectives.	n.a.	.400	n.a.	.833	.667	.250	.522
4	Did you write a resume for a specific career objective?	n.a.	n.a.	n.a.	.200	n.a.	.600	.400
5	Did you participate in a practice interview?	n.a.	1.000	0	0	n.a.	.800	.563

(a) Combined proportion based on data from all CPS participants
(b) n.a. indicates not available
(c) Multiply this and other numbers in the table by 100 to obtain percentage values
(d) Values in this table represent the proportion of CPS participants who satisfied the criteria for successful fulfillment of the objective

TABLE II

AVERAGE RATINGS OF CPS MEETINGS

	SESSION #1	SESSION #2	SESSION #3	SESSION #4	SESSION #5	OVERALL (a)
CPS #1	38 n.a.	n.a. n.a. (b)	14 (c) n.a.	n.a. n.a.	6 n.a.	14 82.9
CPS #2	35 78.9	14 91.4	10 83.0 (d)	n.a. n.a.	10 89.0	10 91.0
CPS #3	11 82.7	6 93.3	n.a. n.a.	1 100.0	6 90.0	6 (d) 96.7
CPS #4	16 68.8	6 73.3	11 61.8	9 79.4	7 85.7	7 82.9
CPS #5	13 86.2	7 82.9	6 80.0	n.a. n.a.	n.a. n.a.	n.a. n.a.
CPS #6	10 78.0	6 76.7	10 81.0	9 73.3	9 91.1	9 88.9

(a) Separate rating obtained at fifth session
(b) n.a. indicates not available
(c) Numbers in this and similar locations in this table indicate the number of responses
(d) Numbers in this and similar locations in this table indicate the average session rating

Number	Value or Benefit
0	negligible
20	poor
40	below average
60	above average
80	good
100	excellent

The number in the upper right hand corner of each box indicates the number of responses.

It can be seen that every session of every Seminar was rated above average. Many sessions rated between good and excellent. The overall rating in Table II is not a numerical average rating but is rather an overall assessment made by the participants at the last session of each Seminar. It is noted that all Seminars received an overall rating between good and excellent. This indicates a great deal of enthusiasm on the part of the participants for the Career Perspective Seminar.

The formulation of the present career development format was left as loose as could be tolerated in order to provide maximum flexibility for the coordinators, speakers, advisors and participants. The coordinators felt that planning time was always short and that, in most cases, there was inadequate publicity. Despite these shortcomings, many objectives were met reasonably well, the participant ratings were quite good and for the most part were reproducible from Seminar to Seminar. There is room for improvement in the degree to which most objectives were met. However, it is felt that this could only be done by reducing the program format flexibility. Whether or not the format should be tightened is a decision that future coordinators will have to make.

If the format is to be tightened up for future Seminars, several factors should be considered. Program objectives might be stressed more to program speakers, moderators or advisors and attendees. This might be done by holding a kickoff meeting for all program speakers, moderators and coordinators prior to any presentation of the CPS. The purpose of the meeting would be to go over the specific objectives of each session of the program. The desired outcomes of each meeting, motivation factors, the relationship between consecutive meetings, the relationship of each meeting to the overall program and methods for improving effectiveness could be discussed at such meetings. The need for the participants to completely engage in the appropriate practice activity for the last three sessions should be emphasized. This appropriate practice activity would include preparation of letters and resumes and engaging in practice interviews. It should be kept in mind, however, that students spend a good deal of time in a more or less formal classroom atmosphere. If the CPS is tightened up too much, it may remind the students of a more or less formal class and thereby lose its attractiveness.

Conclusion

The concept that we are in the midst of a job revolution[40] was an accepted thesis during the development of the Career Perspective Seminar. Engineering life styles are not only different in different parts of the world,[41] but they are constantly changing as a result of the accelerative thrust of our high technology society. Engineering education and career development concepts for practicing engineers must address the rapidly changing engineering requirements of our society.[42,43] Educational institutions,[44] engineering employers[45] and professional societies[46] must complement each other in their efforts to meet the professional needs of individual engineers.

The Career Perspective Seminar was established to suggest elements of a very rough framework within which the engineering student may effectively participate in the transition from the academic to the professional phase of his career. The CPS suggests that significant elements in this transition include student awareness and capability to describe and evaluate the:

(1) changing engineering requirements as indicated by the projected goals of industry.

(2) role of professional and technical societies in career development.

(3) importance of establishing and constantly updating career objectives.

(4) way in which his education, training and experience qualify him to meet changing engineering requirements.

(5) effectiveness with which he can verbalize his capability to function as a problem solver of the technological problems created by our changing society.

When a Career Perspective Seminar is held, any student may attend if he or she is interested, whether or not he or she is a student member of AIAA. An AIAA Student Branch usually serves as sponsor for the event and usually arranges for the physical facilities necessary to conduct the Seminar. In many cases the Student Branch also provides refreshments for participants. Seminars held to date have enjoyed outstanding reviews by student participants.

This approach to career development is not entirely unique. Colleges and universities offer courses related to "professional development," either as part of the regular engineering curriculum or through extension programs.[47,48] Other societies have addressed some of the problems of graduating students.[49] However, not all of these programs have the scope of the CPS.

The concepts of career planning are difficult to grasp and apply at best. This is, perhaps, most painfully true for the college senior or graduate student. His or her foremost aim at this point in his career is "finishing" his education and obtaining a job. Discussing the topics of obsolescence, career goals and the need for flexibility may be seen by the student to be irrelevant. By exposing the student to some of these concepts early in his career, it is hoped that a train of thought will develop and forestall future difficulties of the type described in the introduction of this paper.

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